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HIGHLIGHTED ARTICLES

[What caused the recent “Warm Arctic, Cold Continents” trend pattern in winter temperatures?](#)

Geophysical Research Letters (4.456)

[Water quality criteria for an acidifying ocean—Challenges and opportunities for improvement](#)

Ocean & Coastal Management (1.748)

[Genetic structure of the beaked whale genus *Berardius* in the North Pacific, with genetic evidence for a new species](#)

Marine Mammal Science (1.820)

[Towards a balanced presentation and objective interpretation of acoustic and trawl survey data, with specific reference to the eastern Scotian Shelf](#)

Canadian Journal of Fisheries and Aquatic Sciences (2.287)

[Acknowledging the voice of women: implications for fisheries management and policy](#)

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Conservation Letters (5.032)



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NMFS Publications

[Effects of plant-based lipid feeds on hepatic and gastrointestinal histology and the gastrointestinal microbiome of sablefish \(*Anoplopoma fimbria*\)](#)

Aquaculture (2.341)

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WIREs Water (N/A)

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[Evaluating the Ryman-Laikre effect for marine stock enhancement and aquaculture](#)

Current Zoology (1.814)



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[Bloom or bust: synchrony in jellyfish abundance, fish consumption, benthic scavenger abundance, and environmental drivers across a continental shelf](#)

Fisheries Oceanography (2.542)

[Historic potential spawning abundance estimates for Columbia River Basin salmon and steelhead in areas above Bonneville Dam](#)

North American Journal of Fisheries Management (0.954)

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Marine Mammal Science (1.936)

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ICES Journal of Marine Science (2.377)

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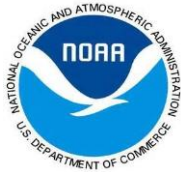
ICES Journal of Marine Science (2.377)

[A socioeconomic evaluation of a network of deep-water marine protected areas](#)

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Environmental Biology of Fishes (1.570)

[Evaluating the influence of skipper skills in the performance of Portuguese artisanal dredge vessels](#)

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OTHER REPORTS, BOOK CHAPTERS, AND INTERNAL PUBLICATIONS

[NMFS Publications](#)

[Federal interagency nature-like fishway passage design guidelines for Atlantic coast diadromous fishes](#)

NMFS and UMass Fish Passage Technical Memorandum

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HIGHLIGHTED ARTICLES

What caused the recent “Warm Arctic, Cold Continents” trend pattern in winter temperatures?

Geophysical Research Letters (4.456)

L. Sun, J. Perlwitz, M. Hoerling (OAR/ESRL/PSD)

- The authors find that Arctic sea ice loss is responsible for a warming Arctic but not for observed cold continents in the lower latitudes. Their results suggest that while much of the Arctic amplification in surface warming results from sea ice loss, neither sea ice loss nor anthropogenic forcing overall causes the trend toward colder continental temperatures.
- Observed cooling is instead attributed to strong articulation of internal atmospheric variability.
- The authors do find evidence, however, for the impact of sea ice loss on weather variability over the midlatitude continents. There, sea ice loss is responsible for reduced daily temperature variability and fewer cold extremes.

The emergence of rapid Arctic warming in recent decades has coincided with unusually cold winters over Northern Hemisphere continents. It has been speculated that this “Warm Arctic, Cold Continents” trend pattern is due to sea ice loss. Here we use multiple models to examine whether such a pattern is indeed forced by sea ice loss specifically and by anthropogenic forcing in general. While we show much of Arctic amplification in surface warming to result from sea ice loss, we find that neither sea ice loss nor anthropogenic forcing overall yield trends toward colder continental temperatures. An alternate explanation of the cooling is that it represents a strong articulation of internal atmospheric variability, evidence for which is derived from model data, and physical considerations. Sea ice loss impact on weather variability over the high-latitude continents is found, however, to be characterized by reduced daily temperature variability and fewer cold extremes.

Publication Date: 25 May 2016



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Available online:

<http://onlinelibrary.wiley.com/doi/10.1002/2016GL069024/abstract>

Water quality criteria for an acidifying ocean—Challenges and opportunities for improvement

Ocean & Coastal Management (1.748)

S. B. Weisberg, N. Bednaršek, **R.A. Feely (OAR/PMEL)**, F. Chan, A. B. Boehm, M. Sutula, J. L. Ruesink, B. Hales, J. L. Largier, and J. A. Newton

- Clean Water Act 303(d) assessments for ocean acidification are challenging.
- Chemical assessment is limited by pH criteria at levels below that known to cause biological damage.
- Biological assessments are limited by lack of co-location between biological and chemical monitoring.
- Changes to existing criteria are needed to protect aquatic life and support acidification management.

Acidification has sparked discussion about whether regulatory agencies should place coastal waters on the Clean Water Act 303(d) impaired water bodies list. Here we describe scientific challenges in assessing impairment with existing data, exploring use of both pH and biological criteria. Application of pH criteria is challenging because present coastal pH levels fall within the allowable criteria range, but the existing criteria allow for pH levels that are known to cause extensive biological damage. Moreover, some states express their water quality criteria as change from natural conditions, but the spatio-temporal distribution and quality of existing coastal pH data are insufficient to define natural condition. Biological criteria require that waters be of sufficient quality to support resident biological communities and are relevant because a number of biological communities have declined over the last several decades. However, the scientific challenge is differentiating those declines from natural population cycles and positively associating them with acidification-related water quality stress. We present two case studies, one for pteropods and one for oysters, which illustrate the opportunities, challenges and uncertainties associated with implementing



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biological criteria. The biggest challenge associated with these biological assessments is lack of co-location between long-term biological and chemical monitoring, which inhibits the ability to connect biological response with an acidification stressor. Developing new, ecologically relevant water quality criteria for acidification and augmenting coastal water monitoring at spatio-temporal scales appropriate to those criteria would enhance opportunities for effective use of water quality regulations.

Publication Date: June 2016

Available online:

<http://www.sciencedirect.com/science/article/pii/S0964569116300357>

Genetic structure of the beaked whale genus Berardius in the North Pacific, with genetic evidence for a new species

Marine Mammal Science (1.820)

P. A. Morin(NMFS/SWFSC), C. S. Baker, R. S. Brewer, A. M. Burdin, M. L. Dalebout, J. P. Dines, I. Fedutin, O. Filatova, E. Hoyt, J.L. Jung, **M. Lauf** (NMFS/SWFSC), C. W. Potter, G. Richard, M. Ridgway, **K. M. Robertson** (NMFS/SWFSC), **P. R. Wade**(NMFS/AFSC)

- Genetic evidence for a new species of beaked whale in the North Pacific related to Baird's beaked whale.
- New species known from only 8 strandings (3 in Japan, 5 in the Bering Sea).
- Low diversity and minimal evidence of population structure within Baird's beaked whale across the North Pacific.

There are two recognized species in the genus *Berardius*, Baird's and Arnoux's beaked whales. In Japan, whalers have traditionally recognized two forms of Baird's beaked whales, the common "slate gray" form and a smaller, rare "black" form. Previous comparison of mtDNA control region sequences from three black specimens to gray specimens around Japan indicated that the two forms comprise different stocks and potentially different species. We have expanded sampling to include control region haplotypes of 178 Baird's beaked whales from across their range in the North Pacific. We identified five additional specimens of the black



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form from the Aleutian Islands and Bering Sea, for a total of eight “black” specimens. The divergence between mtDNA haplotypes of the black and gray forms of Baird’s beaked whale was greater than their divergence from the congeneric Arnoux’s beaked whale found in the Southern Ocean, and similar to that observed among other congeneric beaked whale species. Taken together, genetic evidence from specimens in Japan and across the North Pacific, combined with evidence of smaller adult body size, indicate presence of an unnamed species of *Berardius* in the North Pacific.

Accepted: 21 May 2016

Towards a balanced presentation and objective interpretation of acoustic and trawl survey data, with specific reference to the eastern Scotian Shelf

Canadian Journal of Fisheries and Aquatic Sciences (2.287)

J. M. Jech (NMFS/NEFSC), I. J. McQuinn

- The authors found that the abundance of forage fish has not increased in response to the demise of cod and other top predators, and the reliance on a single sampling gear with low catchability has biased and will continue to bias the interpretation of demographic trends of pelagic fish populations.
- The authors advocate that multiple sampling technologies providing alternative perspectives are needed for the monitoring and management of the various trophic levels if we are to achieve a balanced and objective understanding of marine ecosystems.

A debate has developed over the ecosystem consequences following the collapse of Atlantic cod throughout the coastal waters of eastern Canada. The explosive increase in pelagic fish abundance in scientific bottom-trawl catches on the eastern Scotian Shelf has been interpreted as either being due to (a) a “pelagic outburst” of forage fish abundance resulting from predator release or conversely to (b) a change in pelagic fish vertical distribution leading to a “suprabenthic habitat occupation” thereby increasing their availability to bottom trawls. These two interpretations have diametrically opposing ecological consequences and suggest different management strategies for these important forage fish species. We argue that an objective evaluation of the available evidence supports the hypothesis that the



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abundance of forage fish has not increased in response to the demise of cod and other top predators, and the reliance on a single sampling gear with low catchability has biased and will continue to bias the interpretation of demographic trends of pelagic fish populations. We advocate that multiple sampling technologies providing alternative perspectives are needed for the monitoring and management of the various trophic levels if we are to achieve a balanced and objective understanding of marine ecosystems.

Accepted: 16 May 2016

Acknowledging the voice of women: implications for fisheries management and policy

Marine Policy (2.407)

S. Calhoun, F. Conway, **S. Russell (NMFS/NWFSC)**

- Informs management that the role of women in commercial fishing is changing and how Fishery Council's and NMFS outreach communicates with fishermen may need to change as more women increase roles in commercial fishing.

Commercial fishing research often focuses on ecological (gear, stock-assessment, traceability) or economic factors or indicators. Truly understanding the social-ecological system requires considering the social, cultural, historical, and legal/policy aspects as well. Although regulatory bodies now include human dimensions in their management plans, there are still challenges to integrating social science into the decision-making process. There is a national and international understanding that if resource managers are to understand and develop strategies for coastal resilience, a holistic approach is needed that includes an understanding of the intersection between the dynamics of fisheries management and women's participation within fishing. The objective of this study was to collect oral history data related to past and current strategies for addressing fishing family and community resilience over time. Literature has documented ways in which limited access and catch share programs affect fishing community resilience and sustainability, but have few data that look at how these management systems may be affecting women's roles and participation within the industry. The



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results from this research add to the literature on women's roles in the US and provide needed attention to their contribution to the wellbeing, resilience, and adaptive capacity of Oregon's evolving commercial fishing industry

Accepted: 20 April 2016

Consistent extinction risk assessment under the U.S. Endangered Species Act
Conservation Letters (5.032)

C. Boyd (NMFS/SWFSC), D. P. DeMaster (NMFS/AFSC), R. S. Waples (NMFS/NWFSC), E. J. Ward (NMFS/NWFSC), B. L. Taylor (NMFS/SWFSC)

- This study presents a retrospective analysis of past endangered or threatened species listing decisions under the Endangered Species Act (ESA).
- The risk assessment framework developed here could enable more consistent, predictable, and transparent ESA status assessments in the future.

Identifying species at risk of extinction is essential for effective conservation priority-setting in the face of accelerating biodiversity loss. However, the levels of risk that lead to endangered or threatened listing decisions under the United States Endangered Species Act (ESA) are not well defined. We used a Bayesian population modeling approach to estimate levels of risk consistently for 14 marine species previously assessed under the ESA. For each species, we assessed the risks of declining below various abundance thresholds over various time horizons. We found that high risks of declining below 250 mature individuals within five generations matched well with ESA endangered status, while number of populations was useful for distinguishing between threatened and “not warranted” species. The risk assessment framework developed here could enable more consistent, predictable, and transparent ESA status assessments in the future.

Accepted: 17 May 2016



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ADDITIONAL ARTICLES

NMFS Publications

Effects of plant-based lipid feeds on hepatic and gastrointestinal histology and the gastrointestinal microbiome of sablefish (Anoplopoma fimbria)

Aquaculture (2.341)

L. D. Rhodes, R. B. Johnson, M. S. Myers (NMFS/NWFSC)

- Fish-based lipid diet produced better growth in sablefish than plant-based lipid diets.
- Liver pathology was observed only in sablefish receiving plant-based lipid diets. Gut microbiome was more diverse in fish receiving fish-based lipid diet.
- Multidisciplinary evaluation of alternative feeds is important for new aquaculture species.

Sablefish (*Anoplopoma fimbria*) is a highly desired seafood product, which encourages development of sustainable aquaculture methods for this marine fish. Conventional marine fish-based feeds provide essential nutrients including long chain fatty acids for piscivorous species such as sablefish. Alternative terrestrial ingredients could reduce fishing pressures on pelagic species that are the source of fish meal and fish oil, and improve source sustainability. Using juvenile sablefish, we compared the effects of a standard fish-based diet to two diets that contained primarily terrestrial plant ingredients with flaxseed or corn oil replacing the added fish oil. After an 8-week trial feeding period, there were striking differences attributable to diet. Fish receiving the alternative feeds had lower weight gain and shorter length than fish receiving the fish-based feed, suggesting sablefish obtained lower nutrients from the alternative feeds. Among the histological differences, the intestinal mucosa was significantly less vacuolated and the frequency of intestinal mucous cells was reduced in alternative feed fish. The most dramatic lesions were observed in the liver, where severe bile duct hyperplasia (53%, flaxseed oil diet; 33%, corn oil diet), and hepatocellular lesions (nuclear pleomorphism/megalocytosis, regeneration, hypertrophy, clear cell foci) occurred



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in only alternative feed fish. The hepatic and biliary lesions indicate the alternative diets may be deficient or possibly harmful to sablefish. The bacterial community structures from corn oil fish showed much less diversity than those for the other diets, and the microbiome structures from the three diets were distinctly different from each other. The intestinal microbiome for the fish-based diet included the largest number of families (68) and these fish also had the largest number of unique bacterial families (11) compared to those for corn oil (two) or flaxseed oil (one) fish. Regardless of diet, the stomach and intestinal microbiomes differed significantly from each other, and the feed microbiome differed from all gastrointestinal communities, suggesting that feed is not a significant source of gut bacterial diversity. Similar to other teleosts, the sablefish gastrointestinal microbiome is dominated by Bacteroidetes, Firmicutes, and Proteobacteria. These results suggest that diet-induced shifts in microbiome can occur relatively quickly in sablefish, but the shifts may not be sufficiently adaptive or cannot overcome nutrient deficiencies. This multidisciplinary study demonstrates the utility of histology and microbiology in characterizing dietary effects for novel aquaculture species.

Publication Date: 8 May 2016

Available Online:

<http://www.sciencedirect.com/science/article/pii/S0044848616302472>

Status and trends of dam removal in the United States

WIREs Water

J.R. Bellmore, J.J. Duda, L.S. Craig, S.L. Greene, C.E. Torgersen, **M.J. Collins** (NMFS/OHC), and K. Vittum

- The authors review the status and trends of dam removal science in the United States in order to characterize the science in light of current and future practice relevance.
- There is a growing body of scientific literature that reports the outcomes of dam removal, but there are also numerous gaps in the literature that may limit the ability of this research to inform decision making.



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- These challenges can be overcome by articulating and prioritizing research needs and questions, facilitating regional and national coordination of research, and improving the accessibility and communication of dam removal science to researchers and managers.

Aging infrastructure coupled with growing interest in river restoration has driven a dramatic increase in the practice of dam removal. With this increase, there has been a proliferation of studies that assess the physical and ecological responses of rivers to these removals. As more dams are considered for removal, scientific information from these dam-removal studies will increasingly be called upon to inform decisions about whether, and how best, to bring down dams. This raises a critical question: what is the current state of dam removal science in the United States? To explore the status, trends, and characteristics of dam-removal research in the U.S. we searched the scientific literature and extracted basic information from studies on dam removal. Our literature review illustrates that although over 1,200 dams have been removed in the U.S., fewer than 10% have been scientifically evaluated, and most of these studies were short in duration (<4 years) and had limited (1–2 years) or no pre-removal monitoring. The majority of studies focused on hydrologic and geomorphic responses to removal rather than biological and water-quality responses, and few studies were published on linkages between physical and ecological components. Our review illustrates the need for long-term, multidisciplinary case studies, with robust study designs, in order to anticipate effects of dam removal and inform future decision-making.

Accepted: 18 May 2016

The impact of alternative rebuilding strategies to rebuild overfished stocks
ICES Journal of Marine Science (2.525)

C. R. Wetzel (NMFS/NWFSC), A. E. Punt

- Management strategy evaluation is applied to evaluate alternative rebuilding approaches for US west coast groundfish.

Ending overfishing and rebuilding fish stocks to levels that provide for optimum sustainable yield is a concern for fisheries management worldwide. In the US, fisheries managers are legally mandated to end overfishing and to implement



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rebuilding plans for fish stocks that fall below minimum stock size thresholds. Rebuilding plans should lead to recovery to target stock sizes within ten years, except in situations where the life history of the stock or environmental conditions dictate otherwise. Federally managed groundfish species along the US West Coast have diverse life histories where some are able to rebuild quickly from overfished status, while others, specifically rockfish (*Sebastes spp.*), may require decades for rebuilding. A management strategy evaluation which assumed limited estimation error was conducted to evaluate the performance of alternative strategies for rebuilding overfished stocks for these alternative US West Coast life histories. Generally, the results highlight the trade-off between the reduction of catches during rebuilding vs. the length of rebuilding. The most precautionary rebuilding plans requiring the greatest harvest reduction resulted in higher average catches over the entire projection period compared to strategies that required a longer rebuilding period with less of a reduction in rebuilding catch. Attempting to maintain a 50% probability of rebuilding was the poorest performing rebuilding strategy for all life histories, resulting in a high number of changes to the rebuilding plan, increased frequency of failing to meet rebuilding targets, and higher variation in catch. The rebuilding plans that implemented a higher initial rebuilding probability ($\geq 60\%$) for determining rebuilding fishing mortality and targets generally resulted in fewer changes to the rebuilding plans and rebuilt by the target rebuilding year, particularly for stocks with the longer rebuilding plans (e.g. rockfishes).

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Available Online:

<http://icesjms.oxfordjournals.org/content/early/2016/05/18/icesjms.fsw073.abstract>

Ecosystem context and historical contingency in apex predator recoveries

Science Advances

A. C. Stier, J. F. Samhouri, K. N. Marshall, E. J. Ward, M. Novak, P. S. Levin
(NMFS/NWFSC)

- By seeking a mechanistic understanding of how apex predators are connected to the ecological and socio-economic system that surrounds them,



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and timing recoveries just right, we have the opportunity to identify efficient win-win solutions that offer dual prosperity to these majestic carnivores and the human systems within which they are embedded.

Habitat loss, overexploitation, and numerous other stressors have caused global declines in apex predators. This “trophic downgrading” has generated widespread concern because of the fundamental role apex predators play in ecosystem functioning, disease regulation, and biodiversity maintenance. In attempts to combat declines, managers have conducted reintroductions, imposed stricter harvest regulations, and implemented protected areas. Here we suggest that full recovery of viable apex predator populations is currently the exception rather than the rule. We argue that in addition to well-known considerations such as continued exploitation and slow life histories, there are several underappreciated factors that complicate predator recoveries. These factors include the following challenges of: (i) identifying the suite of trophic interactions that will influence recovery a priori, (ii) defining and accomplishing predator recovery in the context of a dynamic ecosystem, and (iii) designing adaptive sequences of management strategies that embrace key interactions. Consideration of recent research on food web modules, alternative stable states, and community assembly offer important insights for predator recovery efforts and restoration ecology more generally. Foremost among these is the importance of a social-ecological perspective in facilitating a long-lasting predator restoration while avoiding unintended consequences.

Publication Date: 27 May 2016

Available Online:

<http://advances.sciencemag.org/content/2/5/e1501769.full.pdf+html>

On making statistical inferences regarding the relationship between spawners and recruits and the irresolute case of western Atlantic bluefin tuna (Thunnus thynnus)
PLoS ONE (3.534)

C. E. Porch and M. V. Laretta (NMFS/SEFSC)

- Stock-recruitment model selection approaches can be misleading, particularly when most of the data come from around a stable steady state



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such that all the parametric models are approximately linear and approximately identical.

- In the case of western Atlantic bluefin tuna, the management regulations promulgated over the last 30 years have worked to the effect of maintaining a relatively stable biomass and, without further reductions in catch, it seems unlikely that the spawning biomass will increase to a level that would provide enough contrast to identify the most appropriate model even in the absence of any environmentally-driven shifts.
- The authors argue that a more fruitful course of action for western Atlantic bluefin tuna is to move away from the current high/low recruitment dichotomy and focus instead on adopting biological reference points and management procedures that are robust to this and other sources of uncertainty.
- The findings demonstrate the need to modify methods for stock projection of West Atlantic bluefin tuna, to move away from contradictory stock productivity models towards robust biological reference points and management targets.

Forecasts of the future abundance of western Atlantic bluefin tuna (*Thunnus thynnus*) have, for nearly two decades, been based on two competing views of future recruitment potential: (1) a “low” recruitment scenario based on hockey-stick (two-line) curve where the expected level of recruitment is set equal to the geometric mean of the recruitment estimates for the years after a supposed regime-shift in 1975, and (2) a “high” recruitment scenario based on a Beverton-Holt curve fit to the time series of spawner-recruit pairs beginning in 1970. Several investigators inferred the relative plausibility of these two scenarios based on measures of their ability to fit estimates of spawning biomass and recruitment derived from stock assessment outputs. Typically, these comparisons have assumed the assessment estimates of spawning biomass are known without error. It is shown here that ignoring error in the spawning biomass estimates can predispose model-choice approaches to favor the regime-shift hypothesis over the Beverton-Holt curve with higher recruitment potential. When the variance of the observation



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error approaches that which is typically estimated for assessment outputs, the same model-choice approaches tend to favor the single Beverton-Holt curve. For this and other reasons, it is argued that standard model-choice approaches are insufficient to make the case for a regime shift in the recruitment dynamics of western Atlantic bluefin tuna. A more fruitful course of action may be to move away from the current high/low recruitment dichotomy and focus instead on adopting biological reference points and management procedures that are robust to these and other sources of uncertainty.

Accepted: 25 May 2016

Evaluating the Ryman-Laikre effect for marine stock enhancement and aquaculture
Current Zoology (1.814)

R. S. Waples, K. Hindar, S. Karlsson, **J. J. Hard** (NMFS/NWFSC)

- Aquaculture and marine stock enhancement can have negative genetic effects on natural populations.
- This paper develops new tools to analyze a common situation, where a relatively few captive parents contribute a large fraction of offspring to the next generation.

The Ryman-Laikre (R-L) effect is an increase in inbreeding and a reduction in total effective population size (N_eT) in a combined captive-wild system, which arises when a few captive parents produce large numbers of offspring. To facilitate evaluation of the R-L effect for scenarios that are relevant to marine stock enhancement and aquaculture, we extended the original R-L formula to explicitly account for several key factors that determine N_eT , including the numbers of captive and wild adults, the ratio of captive to wild N_e/N (β), productivity of captive and wild breeders, and removal of individuals from the wild for captive breeding. We show how to provide quantitative answers to questions such as: What scenarios lead to no loss of effective size? What is the maximum effective size that can be achieved? and What scenarios insure that N_eT will be no smaller than a specified value? Important results include the following: a) For large marine populations, the value of β becomes increasingly important as the captive contribution increases. Captive propagation will sharply reduce N_eT unless the



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captive contribution is very small or β is very large ($\sim 10^3$ or higher). b) very large values of β are only possible if wild N_e/N is tiny. Therefore, large wild populations undergoing captive enhancement at even modest levels will suffer major reductions in effective size unless wild N_e is a tiny fraction of the census size (about 10^{-4} or lower).

Accepted: 4 May 2016

Available online: <http://cz.oxfordjournals.org/content/early/2016/05/10/cz.zow060>

Bloom or bust: synchrony in jellyfish abundance, fish consumption, benthic scavenger abundance, and environmental drivers across a continental shelf
Fisheries Oceanography (2.542)

B. Smith (NMFS/NEFSC), M. Ford (NMFS/OST), J. Link (NMFS/OAA)

- Time series of gelatinous zooplankton abundance for the Northeast US continental shelf displayed a common, shelf-wide trend with blooms approximately every 10 to 15 years.
- These bloom cycles coincide with spiny dogfish (*Squalus acanthias*) eating gelatinous zooplankton, benthic fish abundance (hagfish, *Myxine glutinosa*; and grenadiers, Macrouridae), and sea surface temperature.
- We show that gelatinous zooplankton blooms are connected to fishes and the environment, inferring a novel coupling between the plankton the fish communities, and highlighting the utility of GZ frequently considered to be avoided by upper trophic levels.

Increases in gelatinous zooplankton (GZ) populations, their dominance of some ecosystems, their impacts to other taxa, and their questionable trophic value remain global concerns, but they are difficult to quantify. We compared trends in GZ abundance from direct sampling for the northeast U.S. continental shelf and tested their association with GZ consumption by spiny dogfish (*Squalus acanthias*); the abundance of two benthic scavengers: Atlantic hagfish (*Myxine glutinosa*) and grenadiers (Family: Macrouridae); and four environmental indices: Atlantic Multidecadal Oscillation, North Atlantic Oscillation, and sea surface and bottom temperatures. Defined as scyphozoans, siphonophores, ctenophores, and salps, the



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abundance of GZ on the shelf has oscillated with blooms approximately every 10 to 15 years. Conservative estimates of annual removal of GZ by spiny dogfish ranged from approximately 0.3 g individual⁻¹ to 298 g individual⁻¹ with spiny dogfish being the primary GZ feeder sampled on the shelf. The examination of three abundance series for GZ identified one shelf-wide trend and strong relationships with 2-year lagged consumption and scavenger abundance (namely hagfish), and sea surface temperature. With multimodel inference, these covariates led to an optimal model of GZ abundance. Blooms of GZ abundance on this shelf were influenced by environmental change, provide surges of food for spiny dogfish, and may offer “food falls” for scavenging fishes. The bioenergetic tradeoffs of consuming greater amounts of GZ compared to other major prey (e.g. fishes) remain unknown; however, these surges of food in the northwest Atlantic appear to be important for fishes, including support for benthic scavenger productivity.

Accepted: 6 May 2016

*Historic potential spawning abundance estimates for Columbia River Basin
salmon and steelhead in areas above Bonneville Dam*

North American Journal of Fisheries Management (0.954)

G. R. Pess, B. McMillan, T. J. Beechie, H. Imaki (NMFS/NWFSC)

- Estimates of historical capacity and abundance levels are critical for salmon population recovery planning.
- These gravel-based estimates are typically ~71% to 88% greater than what was counted in the early to mid-1900s with dams and weirs.
- Improved spawning capacity estimates for the Columbia River will aid in salmon recovery efforts for multiple watersheds in the Columbia River.

Estimates of historical capacity and abundance levels are critical for salmon population recovery planning. We developed a historic salmon spawning capacity estimate for the Columbia River basin using historic habitat information on the proportion of spawning habitat and salmon spawning nest (redd) size from several watersheds and portions of the main stem Columbia. We then used Monte Carlo simulations to gain a distribution of potential capacity by species and watershed.



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We found that total potential spawners in the Columbia River basin for the watersheds and main stem Columbia River is approximately 124.0M (S.D., 48.6M) assuming no space between redds and 41.3M (S.D., 16.2M) assuming redd spacing 3 times larger than the average redd for a given species. We also found that our estimates suggest that the main stem Columbia and Yakima River had greatest capacity for salmonids and that Coho salmon spawning capacity was as large as Chinook salmon capacity. Our gravel-based estimates are typically ~71% to 88% greater than what was counted in the early to mid-1900s with dams and weirs. In addition our overall capacity estimates are larger than previous abundance estimates for the Columbia River basin. However our capacity estimates are comparable to other historic estimates for similar sized watersheds across the Pacific Rim.

Accepted: 23 April 2016

Humpback whales interfering when mammal-eating killer whales attack other species: Mobbing behavior and interspecific altruism?

Marine Mammal Science (1.936)

R. L. Pitman (NMFS/SWFSC), V. B. Deecke, C. M. Gabriele, **M. Srinivasan** (NMFS/OST), N. Black, J. Denking, **J. W. Durban** (NMFS/SWFSC), E. A. Mathews, D. R. Matkin, J. L. Neilson, A. Schulman-Janiger, D. Shearwater, P. Stap, R. Ternullo

- Documents a widespread, but unexpected, interaction between humpback whales and killer whales (humpbacks interfering with attacking killer whales).
- Highlights the potential for unintended consequences associated with efforts to recover large whale populations.

Humpback whales (*Megaptera novaeangliae*) are known to interfere with attacking killer whales (*Orcinus orca*). To investigate why, we reviewed accounts of 115 interactions between them. Humpbacks initiated the majority of interactions (57% vs. 43%; n=72), although the killer whales were almost exclusively mammal-eating forms (MEKWs, 95%) vs. fish-eaters (5%; n=108). When MEKWs approached humpbacks (n=27), they attacked 85% of the time and targeted only



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calves. When humpbacks approached killer whales ($n=41$), 93% were MEKWs, and $\geq 87\%$ of them were attacking or feeding on prey at the time. When humpbacks interacted with attacking MEKWs, 11% of the prey were humpbacks and 89% comprised 10 other species, including 3 cetaceans, 6 pinnipeds, and 1 teleost fish. Approaching humpbacks often harassed attacking MEKWs ($\geq 55\%$ of 56 interactions), regardless of the prey species, which we argue was mobbing behavior. Humpback mobbing sometimes allowed MEKW prey, including nonhumpbacks, to escape. We suggest that humpbacks initially responded to vocalizations of attacking MEKWs without knowing the prey species targeted. Although reciprocity or kin selection might explain communal defense of conspecific calves, there was no apparent benefit to humpbacks continuing to interfere when other species were being attacked. Interspecific altruism, even if unintentional, could not be ruled out.

Accepted: 16 May 2016

Population structure, gene flow, and historical demography of a small coastal shark (Carcharhinus isodon) in U.S. waters of the Western Atlantic Ocean
ICES Journal of Marine Science (2.377)

D. S. Portnoy, C. M. Hollenbeck, **D. M. Bethea (NMFS/SEFSC)**, B. S. Frazier, J. Gelsleichter, J. R. Gold

- Documents significant barriers to gene flow around peninsular Florida and in the eastern Gulf.
- Provides further evidence that the traditional model of behavioural ecology, based on large coastal sharks, may not be appropriate for understanding and conserving small coastal sharks.

Patterns of population structure, genetic demographics, and gene flow in the small coastal shark *Carcharhinus isodon* (finetooth shark) sampled from two discrete nurseries along the southeastern U.S. coast (Atlantic) and three nurseries in the northern Gulf of Mexico (Gulf), were assessed using 16 nuclear-encoded microsatellites and 1077 base pairs of the mitochondrial DNA (mtDNA) control region. Significant heterogeneity in microsatellite allele distributions was detected among all localities except between the two in the Atlantic. Significant



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heterogeneity in mtDNA haplotypes was not detected, a result likely due to extremely low mtDNA diversity. The genetic discontinuities combined with seasonal movement patterns, a patchy distribution of appropriate nursery habitat, the apparent absence of sex-biased gene flow, and the occurrence of mating in the vicinity of nursery areas, suggest that both male and female finetooth sharks display regional philopatry to discrete nursery areas. Global and local tests of neutrality, using mtDNA haplotypes, and demographic model testing, using Approximate Bayesian Computation (ABC) of microsatellite alleles, supported a range-wide expansion of finetooth sharks into U.S. waters occurring less than ~9000 years ago. These findings add to the growing number of studies in a variety of coastally distributed marine fishes documenting significant barriers to gene flow around peninsular Florida and in the eastern Gulf. The findings also provide further evidence that the traditional model of behavioural ecology, based on large coastal sharks, may not be appropriate for understanding and conserving small coastal sharks.

Accepted: 13 May 2016

Assessment of seabird bycatch in the U.S. Atlantic longline fishery, with an extra exploration of the effect of spatial nonstationarity

ICES Journal of Marine Science (2.377)

Y. Li, Y. Jiao, **J A. Browder (NMFS/SEFSC)**

- Provides nominal seabird catch rate for Atlantic U.S. pelagic longline fleet, estimating total fleet seabird bycatch for 21-yr period overall and annually.
- Compares fleet estimates for the three contiguous major catch areas by spatial (SEM) and non-spatial (RYEM) methods, in both cases employing the delta approach to deal with zero-inflated data.
- Spatial relevance was indicated but was more effective in areas with more data and a lower percentage of zero records.

A random-year-effect model (RYEM) developed from pelagic observer data was applied to the pelagic longline logbook database to estimate seabird bycatch for the US Atlantic pelagic longline fishery from 1992 through 2012. During this period, the pelagic observer program (POP) observed 141 seabirds captured on 74 longline



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sets out of a total of 13,847 sets observed. The nominal catch rate was 0.0102 birds per set or 0.014 birds per 1000 hooks. The highest estimate of seabird bycatch occurred in the middle Atlantic bight (MAB), followed by the northeast coast (NEC), fishing areas. Seabird bycatch was greater in summer, fall, and winter than in spring. A majority of birds caught were on longline sets targeting a mixed group of fish species. A spatial expansion model (SEM) was tested for its ability to improve catch estimates. This model produced estimates that were higher but less precise, according to coefficients of variation (CV). For the entire period in the three contiguous areas of greatest bycatch, MAB, NEC, and SAB (the south Atlantic bight), the RYEM estimated 1049, 620, and 145 seabirds caught, respectively, with CV of 16.4%, 18.39%, and 23.45%, respectively. The global SEM estimated 1489, 708, and 155 seabirds caught, respectively, with CV 20.11%, 23.08%, and 25.24%, respectively. The localized SEM estimated 1489, 791, and 265 seabirds caught, respectively, with CV 23.13%, 19.11%, and 65.43%, respectively.

Accepted: 29 April 2016

A socioeconomic evaluation of a network of deep-water marine protected areas Marine Fisheries Review

L. Perruso (NMFS/SEFSC), J. C. Johnson, P. Baertlein (NMFS/SEFSC), D. H. Johnson (NMFS/SERO)

- Delphi methodology has applicability for fishery management decisions when quantitative data is not readily available.
- The deep-water MPAs proposed in the south Atlantic in Amendment 14 are likely to have minor socioeconomic impacts on fishermen and their communities over the long-term.
- Distinct cultures likely exist when biologists and non-biologists (i.e. fishermen, economists, and anthropologists) were evaluated regarding the net socioeconomic impact of deep-water MPAs in the south Atlantic.

Marine protected areas (MPAs) are spatially defined fishery management strategies designed to allow overfished species to recover by excluding fishing effort from certain fishing grounds and essential habitats. When MPA's are established in



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federal waters the net socioeconomic impact to fishery stakeholders must be forecasted. In many cases, conducting a quantitative impact analysis is not possible due to poor spatial resolution of available data. This study implements a semi-quantitative impact assessment based on Delphi methodology to evaluate the net socioeconomic impact of alternative MPA sites proposed for the deep-water component of the snapper-grouper fishery off the southeastern coast of the United States. The results suggest that the approach is tractable and useful to fishery managers when assessing alternative MPA sites in a data-poor environment.

Accepted: 12 May 2016

Encounter with mesoscale eddies enhances survival to settlement in larval coral reef fishes

Proceedings of the National Academy of Sciences (9.674)

K. Shulzitski (NMFS/SEFSC), S. Sponaugle, M. Hauff, K. D. Walter, R. Cowen

- The authors' finding that the pelagic environment encountered by larvae of coral reef fishes significantly influences larval growth, selective mortality, and the composition of survivors has important implications for understanding population connectivity.
- This work suggests that high productivity oceanographic features enhance larval survival and potentially increase the contribution of locally spawned larvae to reef populations.
- Incorporation of spatially explicit larval growth and survivorship into dispersal models will improve quantification of population connectivity for marine organisms both now and in the future

Oceanographic features, such as eddies and fronts, enhance and concentrate productivity, generating high quality patches that dispersive marine larvae may encounter in the plankton. Although broad-scale movement of larvae associated with these features can be captured in biophysical models, direct evidence of processes influencing survival within them, and subsequent effects on population replenishment, are unknown. We sequentially sampled cohorts of coral reef fishes in the plankton and nearshore juvenile habitats in the Straits of Florida and used otolith microstructure analysis to compare growth and size-at-age of larvae



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collected inside and outside of mesoscale eddies to those that survived to settlement. Larval habitat altered patterns of growth and selective mortality: *Thalassoma bifasciatum* and *Cryptotomus roseus* that encountered eddies in the plankton grew faster than larvae outside of eddies and experienced higher survival to settlement. During warm periods, *T. bifasciatum* residing outside of eddies in the oligotrophic Florida Current experienced high mortality and only the slowest growers survived early larval life. Such slow growth is advantageous in nutrient poor habitats when warm temperatures increase metabolic demands but is insufficient for survival beyond the larval stage as only fast-growing larvae successfully settled to reefs. As larvae arriving to the Straits of Florida from distant sources must spend long periods of time outside of eddies, our results indicate that they have a survival disadvantage. High productivity features such as eddies not only enhance the survival of pelagic larvae, but also potentially increase the contribution of locally spawned larvae to reef populations.

Accepted: 12 May 2016

First records of the short-finned pilot whale (Globicephala macrorhynchus) in Massachusetts, USA: 1980 and 2011

Aquatic Mammals (0.702)

K. R. Pugliares, T. W. French, G. S. Jones, M. Niemeyer, **L. A. Wilcox** (NMFS/SEFSC), and B. J. Freeman

- This note reports the first confirmed stranding of short-finned pilot whales north of 41° N latitude along the east coast of the United States, an area that is further north than the known range of this species.
- The animals were initially assumed to be long-finned pilot whales due to the stranding location but proven to be short-finned pilot whales through genetics and morphological analysis.
- The confirmation of short-finned pilot whale strandings outside of their known distribution but within the range of long-finned pilot whales stresses the importance of developing methods to accurately monitor and distinguish between the two species as well as maintaining a stranding network that can



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positively identify the species of stranded individuals for species management.

Abstract: N/A

Accepted: 20 November 2015

Perspectives on the intrinsic rate of population growth

Methods in Ecology and Evolution (6.554)

E. Cortes (NMFS/SEFSC)

- A common method used to estimate extinction risk in vertebrate populations has been used incorrectly and underestimates extinction risk.
- The real issue in underestimating the per capita growth rate (r_{\max}) does not lie in the conceptual model used (density dependence vs density independence), but rather in the biological information used to estimate r_{\max} .
- The results may help to foster discussion between the conservation and fisheries communities since both sub-disciplines ultimately aim to conserve natural resources.

The intrinsic rate of population increase (r_{\max}) is a fundamental metric in ecology and evolution of immediate practical application in conservation and wildlife management. I examine the interpretation of r_{\max} by revisiting the theory behind the density-independent and density-dependent paradigms. The criticism that density-independent approaches underestimate r_{\max} per se, often expressed in the field of fisheries, is shown to be theoretically unfounded. The difficulty of estimating r_{\max} is due to lack of knowledge on the depletion level of the population rather than theory. I reviewed a method commonly used to estimate extinction risk of marine and terrestrial populations and show that it has been used incorrectly. I also examined five other methods to calculate r_{\max} , the Euler-Lotka equation, and four other methods derived from it. I used the same data inputs for a suite of 65 shark populations with a broad range of life histories as an example to show that the incorrectly used extinction risk method overestimates r_{\max} . I compared the r_{\max} values for sharks obtained with the incorrectly applied extinction risk method to published values for other vertebrate taxa to further show that this method generates implausible values for this group of predators. I advocate focusing on



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obtaining estimates of all required vital rates simultaneously when possible while taking into consideration the exploitation history of the population under study as a pragmatic way to provide plausible estimates of r_{\max} . The Euler-Lotka equation and its derivations are recommended for different degrees of data availability, particularly for slow- and medium-growing populations, to provide sensible advice for conservation and management of living vertebrates in situations where a series of credible abundance estimates are not available as is often the case in marine systems. Methods that combine allometry and demography should also be further explored.

Publication date: 21 May 2016

Available online: <http://onlinelibrary.wiley.com/doi/10.1111/2041-210X.12592/abstract>

NOS Publications

Diet and prey selectivity of invasive lionfish (Pterois volitans and P. miles) in Bermuda

Marine Ecology Progress Series (2.619)

C. Eddy, J. Pitt, **J. Morris (NOS/NCCOS)**, S. Smith, G. Goodbody-Gringley, D. Bernal

- This study provides information to help resource managers evaluate which prey species may be most vulnerable to lionfish predation and therefore the species and habitats that may suffer the greatest impact.
- This work suggests that small crustacean species will experience considerable impacts, but the consequences of the intensive selection for these species remains unknown. Although lionfish are consuming some ecologically important teleosts (e.g., bluehead wrasse (*T. bifasciatum*)), herbivorous species (e.g., parrotfish) appear to be targeted less often, suggesting a phase shift to an algae dominated community may not be an immediate concern. However, a commercially important serranid (Atlantic creolefish) is highly-targeted in its juvenile deep reef habitat.



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As a generalist and opportunistic predator, lionfish have a voracious appetite, consuming large quantities of juvenile reef fish and invertebrates, as well as the adults of small-bodied species. To better understand the impacts of these fishes upon invaded coral reef ecosystems, we describe the feeding habits of invasive lionfish in Bermuda based on stomach contents analysis, patterns of prey selection, and the influence of environmental factors on diet. Relative to other regions throughout the northwestern Atlantic, lionfish in Bermuda consume a much greater proportion of crustaceans and prey selection appears to rely upon characteristic traits (e.g., small 28 size and a shallow body) and the relative abundance of available prey species. A lesser-known crustacean, the red night shrimp (*Cinetorhynchus rigens*), is the species of greatest importance to the diet of lionfish. Currently, herbivorous fishes do not make a major contribution to the diet of lionfish in Bermuda, although they frequently target both ecologically (e.g., the bluehead wrasse (*Thalassoma bifasciatum*)) and economically important (e.g., the Atlantic creolefish (*Paranthias furcifer*) species.

Accepted: 10 March 2016

Prevalence of ovotestis in two distant populations of invasive Atlantic lionfish, Pterois volitans and P. miles

Environmental Biology of Fishes (1.570)

J. A. Morris, Jr. (NOS/NCCOS)

- While many studies assume that ovotestis in fish is the result of environmental estrogen pollution or the presence of endocrine disrupting compounds (EDC), we report similar levels of ovotestis in two populations of lionfish captured in the ocean where environmental estrogen concentrations are likely low.
- These data suggest the need for baseline prevalence assessments of ovotestis in both polluted and unpolluted habitats to inform future ecotoxicology and reproductive assessments in fishes.

Ovotestis, the presence of oocytes in testis tissue, is a reproductive abnormality commonly used as a bioindicator of habitat quality. To investigate the prevalence of ovotestis in lionfish (*Pterois volitans* and *P. miles*), 884 individuals were



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collected from the Bahamas and North Carolina between 2004 and 2008. Histological sections of testes were scored for the presence or absence of oocytes. In ovotestis positive individuals, the number of oocytes, size, and developmental stage was recorded. Approximately 15% of lionfish individuals exhibited ovotestis. The prevalence of ovotestis was not significantly different between the two sampled locations. In three individuals from the Bahamas, oocytes of all developmental stages and complete restructuring of the gonadal tissue was observed. All remaining samples displayed only primary stage oocytes and the overall structure of the gonads was normal. While many studies assume that ovotestis in fish is the result of environmental estrogen pollution, we report similar levels of ovotestis in two populations of lionfish captured in the ocean where environmental estrogen concentrations are likely low. These data suggest the need for baseline prevalence assessments of ovotestis in both polluted and unpolluted habitats to inform future ecotoxicology and reproductive assessments in fishes. Expected Publication Date: TBD

Evaluating the influence of skipper skills in the performance of Portuguese artisanal dredge vessels

ICES Journal of Marine Science (2.377)

M. M. Oliveira, A. S. Camanho, **J. B. Walden (NMFS/NEFSC)**, M.B. Gaspar

- Skippers play an important role in vessel performance
- In the Portuguese dredge fishery age and education levels of skippers were more important determinants of vessel efficiency than experience as a skipper.
- Managers should seek to improve the education of skippers in order to increase fishing performance.

It is widely recognized that skippers can have a significant role in their vessels performance levels. However, in many studies which seek to address differences in performance of vessels, the skipper's contribution is often not quantified, or explained fully. This study examines the effect of social factors, such as family heritage, education and professional expertise, on skipper skill and the economic performance of the Portuguese artisanal dredge fleet. This is done using a



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stochastic production frontier model and a data set containing the weekly activity of 54 vessels operating during 2013 and 2014. The results showed that skipper's age, experience in the fishery and educational level are the factors that contribute the most to improve vessel efficiency. In this particular fishery however, experience as a skipper, was not found to be a determinant of enhanced performance, possibly due to the simplicity of the technical equipment onboard. However, age and education levels of skippers were found to be important determinants of efficiency. From a managerial perspective, this indicates that local authorities should consider initiatives to enhance the education levels and professional training of skippers, in order to improve the effectiveness of artisanal fleets.

Accepted: 29 April 2016

OTHER REPORTS, BOOK CHAPTERS, AND INTERNAL PUBLICATIONS

NMFS Publications

Federal interagency nature-like fishway passage design guidelines for Atlantic coast diadromous fishes

NMFS and UMass Fish Passage Technical Memorandum

J. Turek (NMFS/OHC), A. Haro, and B. Towler

- Technical memo provides guidance to engineers and other fish passage practitioners on design of nature-like fishways.
- Seven design guidelines are presented based on fish body morphology and swimming and leaping capabilities for 14 Atlantic Coast diadromous fishes.
- Posted on the NOAA Office of Habitat Conservation (OHC) website

The National Marine Fisheries Service (NMFS), the U.S. Geological Survey (USGS) and the U.S. Fish and Wildlife Service (USFWS) have collaborated to develop passage design guidance for use by engineers and other restoration practitioners considering and designing nature-like fishways (NLFs). The primary purpose of these guidelines is to provide a summary of existing fish swimming and



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leaping performance data and the best available scientific information on safe, timely and effective passage for 14 diadromous fish species using Atlantic Coast rivers and streams. These guidelines apply to passage sites where complete barrier removal is not possible. This technical memorandum presents seven key physical design parameters based on the biometrics and swimming mode and performance of each target fishes for application in the design of NLFs addressing passage of a species or an assemblage of these species. The passage parameters include six dimensional guidelines recommended for minimum weir opening width and depth, minimum pool length, width and depth, and maximum channel slope, along with a maximum flow velocity guideline for each species. While these guidelines are targeted for the design of step-pool NLFs, the information may also have application in the design of other NLF types being considered at passage restoration sites and grade control necessary for infrastructure protection upstream of some dam removals, and in considering passage performance at sites such as natural bedrock features.

Publication date: 18 May 2016

Available online:

http://www.habitat.noaa.gov/pdf/Final_Federal_Interagency_Technical_Memorandum_Fish_Passage_Guidelines.pdf

NOS Publications

Choptank Ecological Assessment: Digital Atlas - Baseline Status Report

NCCOS Technical Memorandum

D. S. Dorfman, L. Bauer, A. Mabrouk, C. Clement, D. M. Nelson, L. Claflin, K. McMahon (NOS/NCCOS)

- The Digital Atlas – Baseline Status Report for the Choptank watershed, a Habitat Focus Area selected by NOAA, integrates research and monitoring information into a single resource.
- As a NOAA Habitat Focus Area is important to assess and characterize important aspects of the ecosystem for design of new management decisions and evaluation of effectiveness of management approaches. Users will now



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have access to the Digital Atlas for their own management, policy, or scientific purposes of the Choptank watershed.

The Choptank watershed was selected by NOAA as a Habitat Focus Area for the Habitat Blueprint Program. As such, NOAA plans an integrated set of activities combining resources from multiple programs to leverage the full weight of our efforts. As one component of the Ecological Assessment, NOAA's National Centers for Coastal Ocean Science (NCCOS) has developed a Digital Atlas. The Digital Atlas integrates information from the full spectrum of research and monitoring within the watershed, compiles it in as a single resource, and serves that information via an internet mapping portal.

Expected Publication Date: TBD